

## **REMARKS**

### **Official Action Paragraphs 1 and 2**

Claims 1-18 have been rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over WO 99/58228. The latter reference injects chlorine in gaseous or liquid form or as a water solution into the flue gas stream to oxidize pollutants in the flue gas stream. The flue gas stream is then scrubbed with water, and alkali metal halogen salt added to precipitate the mercury from the water or water solution. Currently amended claim 1 provides for the alkaline solid particles in the flue gas to adsorb the mercuric halide. No separate scrubbing process is employed as in WO 99/58228. The mercury is oxidized and then adsorbed onto the alkaline solid particles in the flue gas stream. Thus, Applicant's claim 1 does not read on WO 99/58228.

### **Official Action Paragraph 3**

Claims 1-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of Galbreath et al. The Lee abstract refers to a flue gas temperature of 40 °C with the use of chlorine to oxidize the elemental mercury to mercuric chloride. Galbreath et al. simply discloses a

study of chlorination of a coal flue gas, a study of flue gas components and a study of the sorption process of mercury. Galbreath discloses the introduction of HCl into a furnace in which  $\text{Hg}^{\circ}(\text{g})$  has also been injected at temperatures ranging from 770 °C to 1,400 °C (see Fig. 2 of Galbreath et al.). The purpose of Galbreath was to determine whether or not mercury chlorination could be achieved in the combustor. At page 298, section 3.3 and the last sentence in section 4.4 of Galbreath it is stated, "test results are inconclusive for determining whether the apparent formation of  $\text{HgCl}_2(\text{ads})$  involved  $\text{HCl}(\text{g})$ , or  $\text{Cl}(\text{ads})$  as the  $\text{Hg}^{\circ}(\text{g})$  reactant". Thus, it is unclear from Galbreath whether or not formation of  $\text{HgCl}_2(\text{ads})$  would be accomplished by insertion of molecular halogen (i.e.  $\text{Cl}_2$ ). Accordingly, Applicant's insertion of a molecular halogen (and/or a molecular halogen precursor) into the flue gas stream is not suggested by Galbreath.

From the fact that Galbreath et al. employed HCl as the chlorinating agent it is also obvious that Galbreath had no appreciation of the fact that the flue gas composition included alkaline particles because HCl is an acid which destroys alkaline particles.

The Official Action states that it would be obvious that one could combine the disclosure of Lee in using  $\text{Cl}_2$  to chlorinate the flue gas with Galbreath to show the elements of Applicant's claim 1. Galbreath studied only the effect of fly ash components given off from the combustion of Absaloka coal on mercury sorption. As stated, Galbreath added the acid  $\text{HCl}$  to the combustor, which reacts with alkaline particles to destroy them. Thus, Galbreath teaches away from the use of alkaline particles as sorption sites for  $\text{HgCl}_2$ . Lee also does not teach the use of alkaline solid particles in the flue gas as is claimed in claim 1. Consequently, claim 1 is not obvious from Lee in view of Galbreath et al.

Moreover, it is submitted that the idea of combining Lee and Galbreath to lead to the elements of claim 1 was not obvious to either Lee or Galbreath. Galbreath and Lee both worked at the same time on research for the Environmental Protection Agency and both worked on research related to coal combustion in the presence of  $\text{HCl}$ . It is reasonable to assume each were intimately familiar with the work of the other. In fact, Galbreath et al cited work of Goorishi, one of the co-authors of the Lee article (see reference 35 at page 309). Neither Galbreath nor Lee attached any significance to injecting chlorine gas into their greater

than 120 °C. system instead of HCl, notwithstanding the fact that both clearly said that the purpose of their tests was "to establish whether mercury chlorination could be achieved in the combustor". Both Lee and Galbreath are experts in the field of coal combustion and the treatment of flue gases. Yet even two experts both familiar with the work of the other did not think of using alkaline particles as the adsorption sites for HgCl<sub>2</sub>. Accordingly, the references taken as a whole would certainly not suggest the invention to one of ordinary skill in the art.

In any system in which particulate collection solids are used to filter out particles onto which HgCl<sub>2</sub> has been adsorbed, it is obviously necessary to chlorinate the flue gas before the particulate collection devices (PM). In particular for baghouses, which operate between 120 °C and 250 °C (other PM's have a similar range), the flue gas temperature just before the PM must be greater than 120 °C to capture particulate solids (fly ash). The injection of chlorine at 40 °C would be irrelevant to a system using PM's to filter out the aforesaid particles.

#### **Official Action Paragraph 4**

Claims 1-18 having been rejected under 35 USC 112 as being indefinite for having the words "one of ....." in

claim 1 and for having the word "liquid" present. Both of the latter have been deleted.

**Official Action Paragraph 5**

In response to the rejection based upon the use of "absorb" rather than "adsorb" applicant has replaced the word "absorb" with "adsorb", the latter being the one which is obviously intended as in the previous paragraph on line 22, the correct word "adsorbable" is used in the same context.

**Official Action Paragraph 6**

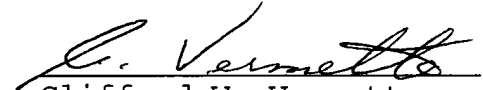
The Examiner also says that there is no support for a flue gas having a temperature greater than 100 °C as recited in claim 1. As indicated on page 7, calcium hypochlorite, one possible thermolabile halogen precursor, decomposes at 100 °C while the two others decompose at higher temperatures. Obviously, in order to define an operative claim it is necessary for the temperature to be at least 100 °C for any of the halogen precursors to decompose into molecular halogen such as chlorine. The conversion of mercury to mercuric halide occurs at the thermodynamically favoured temperature range of 127 °C to 527 °C. There is nothing to suggest either in the specification or from the principles of chemistry that the reaction does not also

occur outside of this range. To define the broadest workable range Applicant has chosen 100 °C as the lower limit.

Accordingly, favourable reconsideration of the present application is respectfully solicited.

Respectfully submitted,

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